

REMARKS

This is intended as a full and complete response to the Final Office Action dated November 29, 2002, having a shortened statutory period for response set to expire on February 28, 2002. Claims 1, 3-4, 6, 8-14, and 17-33 are pending in the application and stand rejected. Applicants have amended base claims 1 and 33 to more clearly recite aspects of the invention. More specifically, Applicants have amended the claims to more clearly recite the temporal relationship of the first and second plasmas. Applicants submit that this amendment does not introduce new matter since this sequence is clearly described in Applicants' specification. (See, specification at page 9, lines 8-19.) Please reconsider the claims pending in the application for reasons discussed below.

✓ Claims 1, 3-4, 21, and 24-33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chang et al.* (U.S. Patent No. 5,043,299). Regarding claims 1 and 33, the Examiner states that although the claimed invention recites "first" and "second" plasmas, the claims do not require a specific order. The Examiner also states that *Chang et al.* teaches using a mixture of hydrogen and helium as a cleaning plasma and then using hydrogen or a carrier gas in a subsequent flushing step. The Examiner, therefore, asserts that so long as the claims lack temporal requirements for the two plasmas, *Chang et al.* teaches the claimed invention. Accordingly, Applicants have amended base claims 1 and 33 to clearly recite the intended sequence of the first and second plasmas, obviating the rejection.

Regarding claims 1, 24 and 33, the Examiner also states that *Chang et al.* teaches a mixture of gases as a cleaning gas so it would have been obvious to use a mixture of gases as the flushing gas because if a mixture is good enough for a cleaning gas then a mixture would be good enough for a flushing gas. Applicants respectfully traverse this rejection. *Chang et al.* teaches loading a wafer in an RIE chamber, cleaning the wafer using a cleaning gas, stopping the flow of the cleaning gas, and flushing the chamber using a carrier gas (argon) or a reducing gas such as hydrogen. After the cleaning and flushing steps are completed, the wafer is removed from the chamber. (See, *Chang et al.* at col. 4, lines 23-47.) *Chang et al.* teaches that the cleaning gas may be mixed with a carrier gas (argon or helium). (See, *Chang et al.* at

col. 3, lines 26-29.) However, contrary to the Examiner's assertion, *Chang et al.* does not teach that the flushing gas is a mixture of hydrogen and helium nor that a carrier gas can be used alone as the cleaning gas. *Chang et al.* clearly teaches that the flushing gas is a carrier gas (argon) or a reducing gas (hydrogen), but not a mixture of both. (See, *Chang et al.* at col. 4, lines 32-34.) Moreover, *Chang et al.* teaches that the flushing step is performed after the cleaning step to remove residues remaining in the chamber created by the cleaning step. (See, *Chang et al.* at col. 4, lines 39-41.)

Accordingly, *Chang et al.* does not teach, show, or suggest cleaning the patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon, cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium, and then depositing a metal on the patterned dielectric layer after exposing the dielectric layer to the first plasma and the second plasma, as recited in claims 1 and 33 as well as those dependent therefrom. Similarly, *Chang et al.* does not teach, show, or suggest cleaning the patterned dielectric layer in a processing chamber with an argon plasma, and then cleaning the patterned dielectric layer in the processing chamber with a hydrogen plasma, as recited in claim 24 and those dependent therefrom. Withdrawal of the rejection and allowance of the claims is respectfully requested.

Claims 1, 3-4, 6, 8-14, and 17-33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Yoo et al.* in view of *Zhao et al.* The Examiner has maintained this same rejection which was appealed by the Applicants. The rejection and the Applicants' traversal argument is re-printed below.

The Examiner states that *Yoo et al.* teaches two plasma etching steps consisting of: (1) a first plasma of argon and (2) a second plasma of helium and a reactive gas such as CF₄ or CF₃H. The Examiner states that *Zhao et al.* teaches an argon plus hydrogen plasma. The Examiner, therefore, asserts that it would have been obvious to one of ordinary skill in the art that "hydrogen was a reactive gas that could have been used equivalently in the process of *Yoo et al.* ... because it was shown to produce like effects in analogous situations and configurations". Furthermore, the Examiner states in the Advisory Action dated May 13, 2002, that *Konenchi* (EP 0849779) and *Subrahmanyam et al.* (WO 99/34424) have teachings similar to *Zhao et al.* and

therefore, "confirm the logic of the combination" (referring to the combination of Yoo *et al.* in view of Zhao *et al.*)

Applicants respectfully traverse the rejection on grounds that the Examiner has not established a case of *prima facie* obviousness. The mere recitation of a combination of references does not amount to particularly identifying a suggestion, teaching, or a motivation to combine the references. (See, M.P.E.P. § 2143.) The teaching or suggestion to make the claimed invention and the reasonable expectation of success must both be found in the prior art, not in the applicants' disclosure. See M.P.E.P. § 2143, citing *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). Still further, the examiner must *particularly* identify any suggestion, teaching or motivation from within the references to combine the references. See *In Re Dembiczak*, 50 USPQ2d 1614 (Fed. Cir. 1999).

Here, the Examiner stated that it would have been obvious to use hydrogen "because it was shown to produce like effects in analogous situations and configurations". This motivation to combine the references identified by the Examiner is merely an unsupported conclusion that the combined elements provide an obvious result or "a logical combination". There is no evidence of record to support the Examiner's stated motivation. Unsupported legal conclusions and impermissible hindsight may not provide a proper basis to support a rejection based on *prima facie* obviousness. Moreover, even though references can be combined or modified, the possibility of a combination is not sufficient to establish *prima facie* obviousness. See M.P.E.P. § 2143.01.

Furthermore, "[i]n determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious." See, M.P.E.P. § 2141.02 citing *Stratoflex, Inc. v. Aeroquip Corp.*, 218 USPQ 871 (Fed. Cir. 1983). Yoo *et al.* teaches an argon sputtering process to smooth corners formed within a feature followed by a "soft-etching" process of a carbon tetrafluoride/helium mixture to decrease contact resistance for a nonsilicided device. (See, Yoo *et al.* at col. 4, line 50 through col. 5, line 13.) Yoo *et al.* also teaches that the soft etching plasma is not needed for silicided devices, which teaches away from a two-

step process recited in the present claims. (See, *Yoo et al.* at col. 5, line 60.) *Zhao et al.* discloses removing oxides from a silicon substrate by forming a plasma of argon and hydrogen.

The Examiner has failed to set forth that the references can be combined to motivate or suggest cleaning a patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon and cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium, as recited in claims 1, 6, 14, 33, and those dependent therefrom. A combination of the references also does not motivate or suggest cleaning the patterned dielectric layer in a processing chamber with an argon plasma and then cleaning the patterned dielectric layer in the processing chamber with a hydrogen plasma, as recited in claim 24 and those dependent therefrom. In fact, none of the references motivate or suggest a step comprising hydrogen and helium as recited in every pending claim. For at least these reasons, Applicants respectfully request withdrawal of the rejection and allowance of the claims.

Claims 6, 8-14, 17-20, and 22-23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Chang et al.* ('299) as applied to claims 1, 3-4, 21, and 24-33 above, and further in view of *Subrahmanyam et al.* and optionally *Yoo et al.* The Applicants' arguments regarding *Chang et al.* and *Yoo et al.* above are equally applicable to this rejection. Applicants note that *Subrahmanyam et al.* is a commonly assigned 102(e) reference and submit that a combination with *Chang et al.* does not motivate or suggest the claimed invention for reasons discussed above. Accordingly, withdrawal of the rejection and allowance of the claims is respectfully requested.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the claimed invention. Having addressed all

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issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) A method for improving metal deposition on a patterned dielectric layer, comprising:

- a) cleaning the patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon;
- b) cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium; and then
- c) depositing a metal on the patterned dielectric layer after exposing the dielectric layer to the first plasma and the second plasma.

33. (Amended) A method for improving metal deposition on a patterned dielectric layer, comprising:

- a) patterning a dielectric layer in a processing chamber to form one or more features having an aspect ratio greater than 1:1;
- b) cleaning the patterned dielectric layer in the processing chamber with a first plasma comprising predominantly argon;
- c) cleaning the patterned dielectric layer in the processing chamber with a second plasma comprising about 5% hydrogen by number of atoms and 95% helium by number of atoms; and then
- d) depositing a metal on the patterned dielectric layer after exposing the dielectric layer to the first plasma and the second plasma.